



Simulation-Based Design



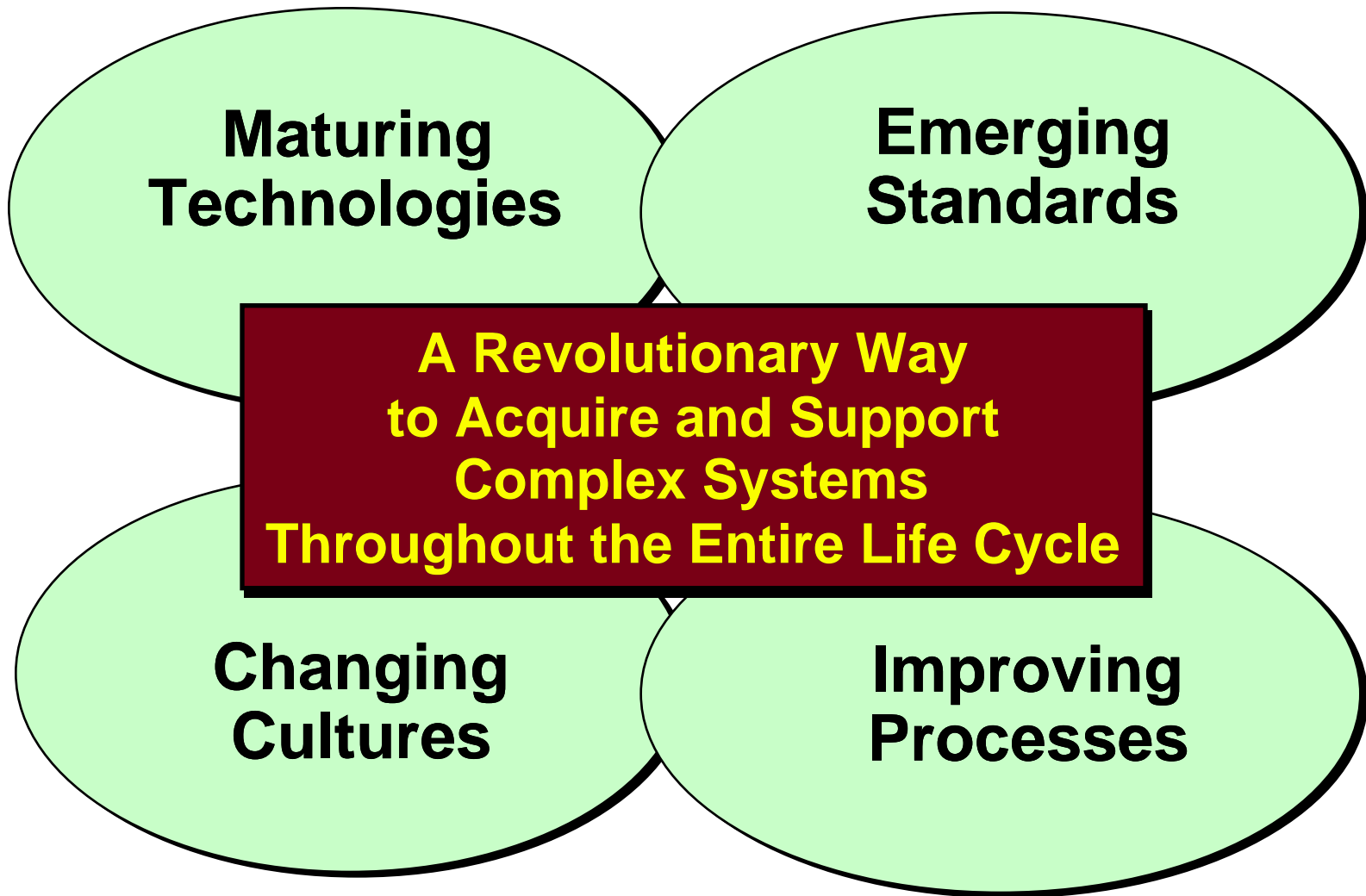
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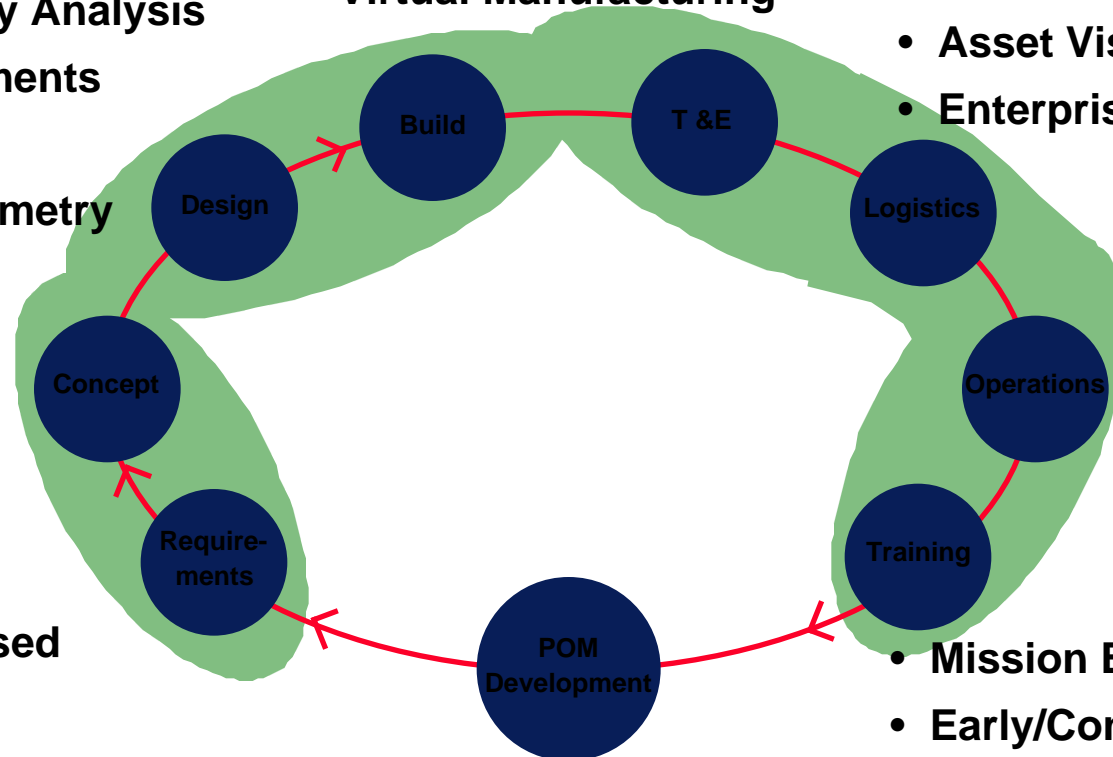
Simulation-Based Design



- Product Model Definition
- Multi-Disciplinary Analysis
- Design Environments
- Simulation
- Solid Model Geometry
- Visualization

- Design for Manufacturability
- Design for Maintainability
- Virtual Manufacturing

- Asset Visibility
- Enterprise Infrastructure



- Performance-Based Costing

- Mission/Concept of Operations
- Procurement Strategy
- Other Life Cycle Considerations
- Process Issues

- Mission Effectiveness
- Early/Continuous Training
- Design for User/Operator
- Train to Maintain



Simulation-Based Design



What is SBD?



An Open Distributed Collaborative System

- IPPD Model
- Common Apps Framework
- Communication Backbone
- Virtual Products in Synthetic Environments



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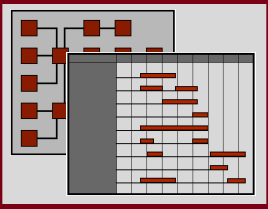
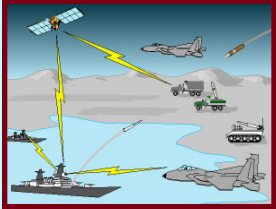

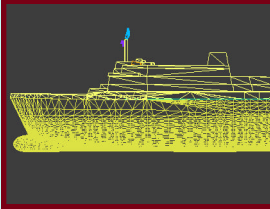


Critical Infrastructure Technologies

- **Smart Product Model (SPM)**
- **Multi-Disciplinary Optimization (MDO) and Multi-Disciplinary Analysis (MDA)**
- **Communications and Collaboration**
- **Virtual Design Environment**

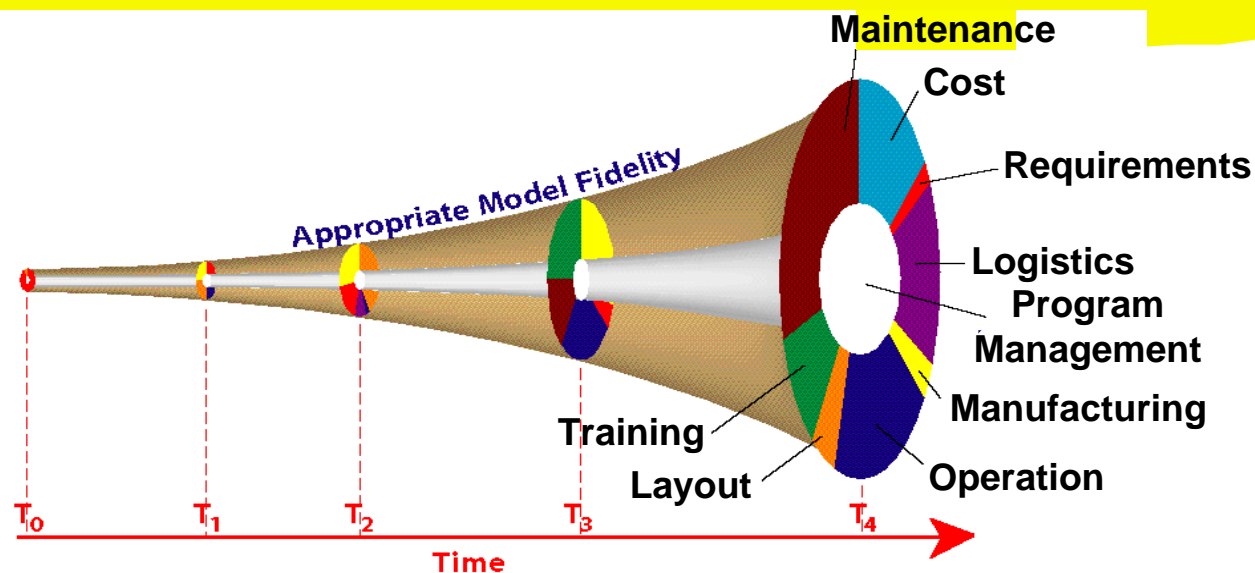


Simulation-Based Design



Acquisition Planning / COEA	Operational Simulation	Parametric Design	Detailed Design	Manufacturing	Operations & Maintenance
					
Reduce Schedule & Cost Cost as an Independent Variable	Best Design from Competitive Virtual Flyoff	Multidisciplinary Optimization for Best Value Design Select Best Manufacturing Process	Rapid Closure on Design Detail Reduction in Downstream Changes	Seamless Transition from Design to Production	Embedded Training On-Line Maintenance Reduce O & M Costs

Greater breadth:



Build it Once, Use Many Times

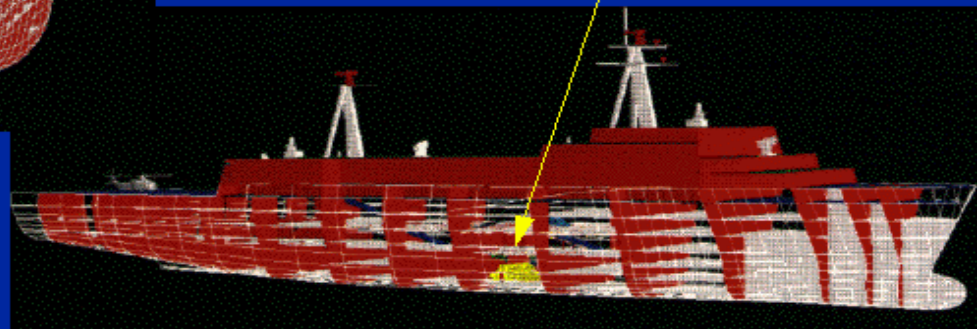
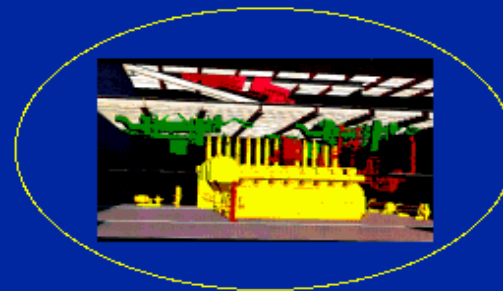


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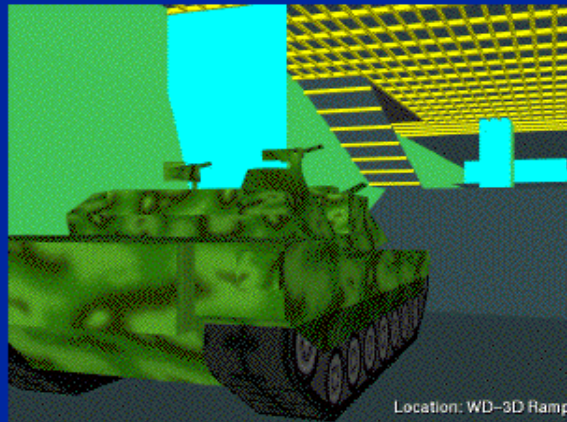


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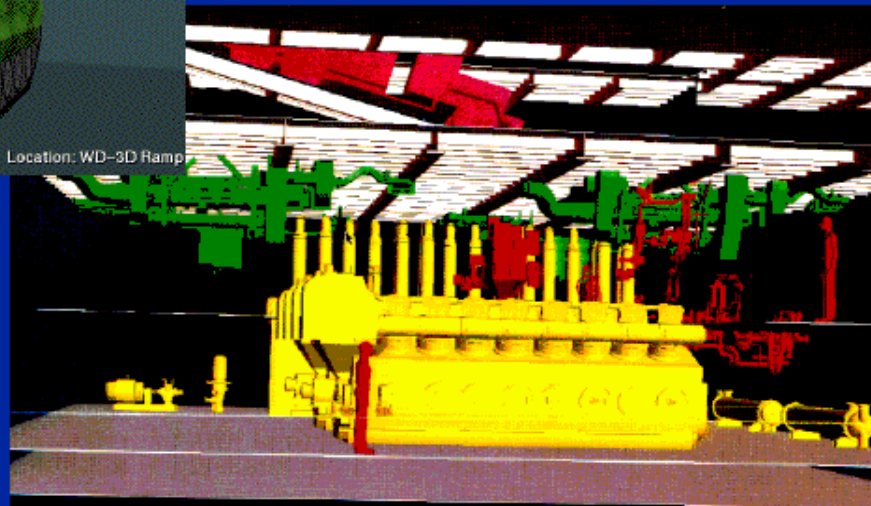




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Location: WD-3D Ramp





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Engineering Federation Experiment



Simulation-Based Design



Engineering Proto-Federation – Prototype Demonstration



Distributed



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Virtual Ship
'rototype in a
Synthetic
osphere/Ocean

Ship

- Virtual Ship Product Model
- Comprehensive Object Description
- Design Variation and Reply Resulting from Threat Interface Collaborative Design Environment Dense
- Product Life Cycle Detail and Demo
- Leads to Elec. System VP w/ Synthetic Environment

- Provides Scalable Engineering Functionality
- Multiple Demos Embedded
 - Design
 - Construction
 - Training
 - Manufacturing
- Ship Radar Computed Remotely

Missile

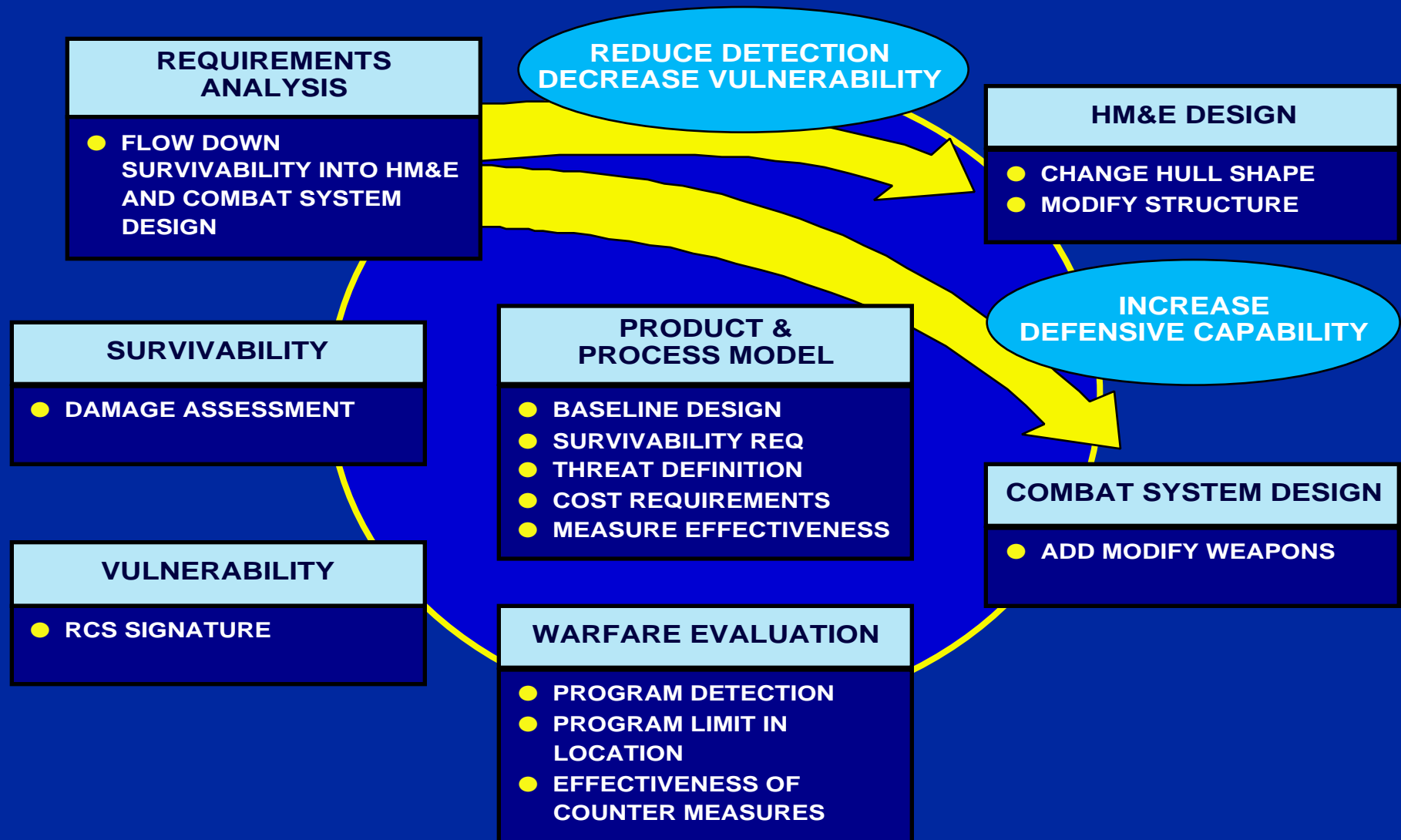
- Simulate or Stimulate
- 6DOF

Aircraft: IADS, T&E-EW, JMASS

- Jammer Interface w/ Aircraft in the Loop

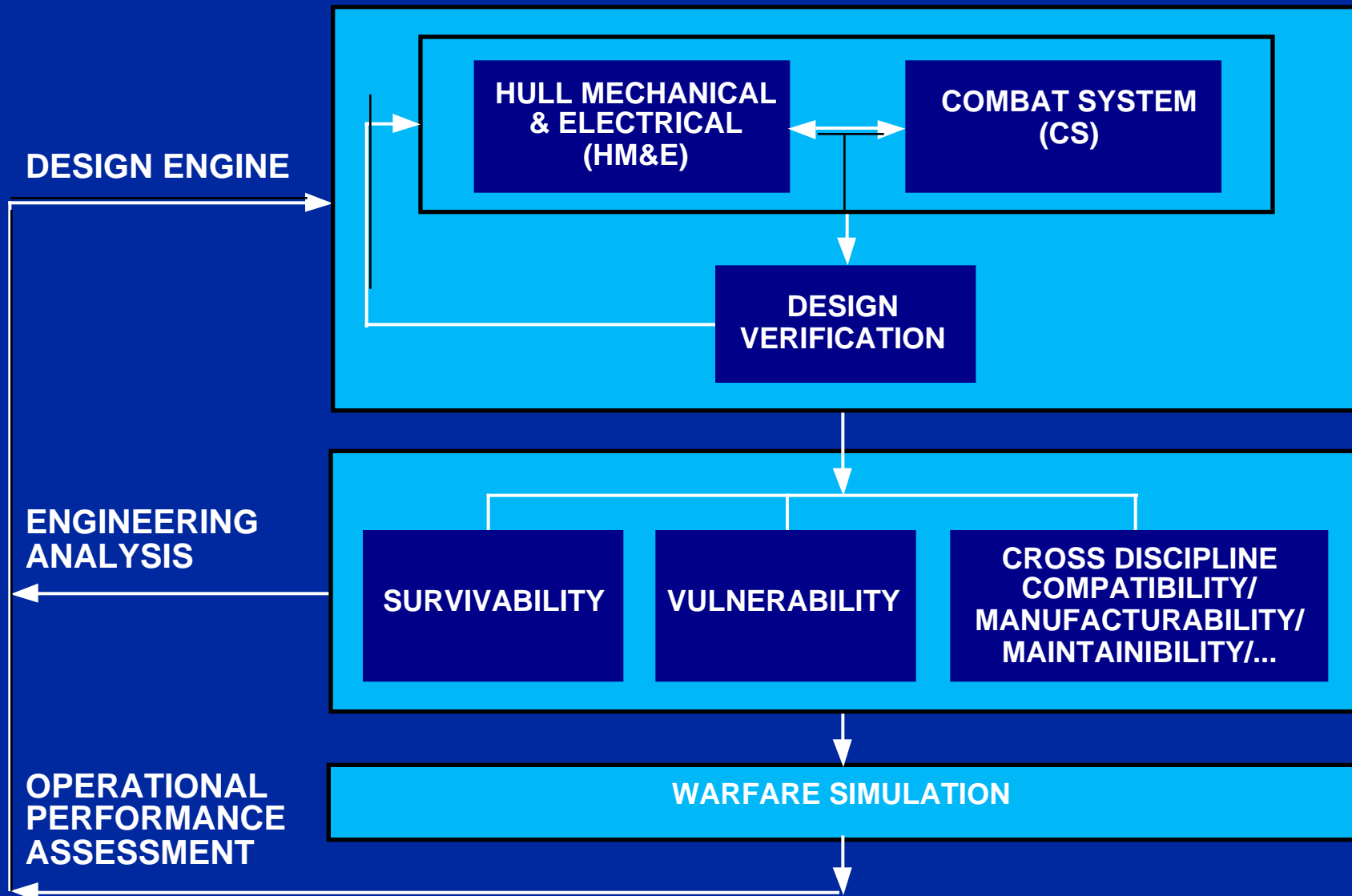


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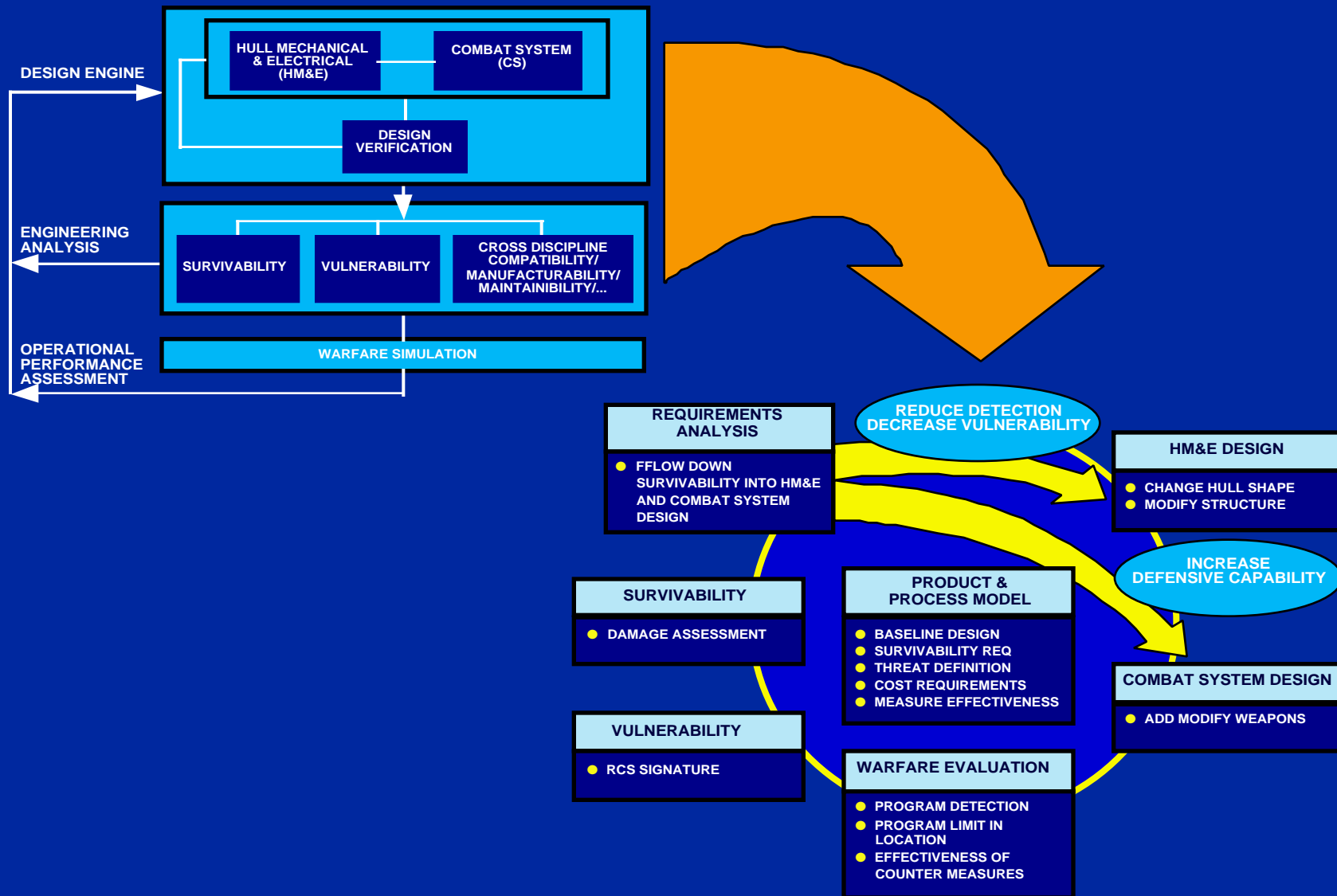


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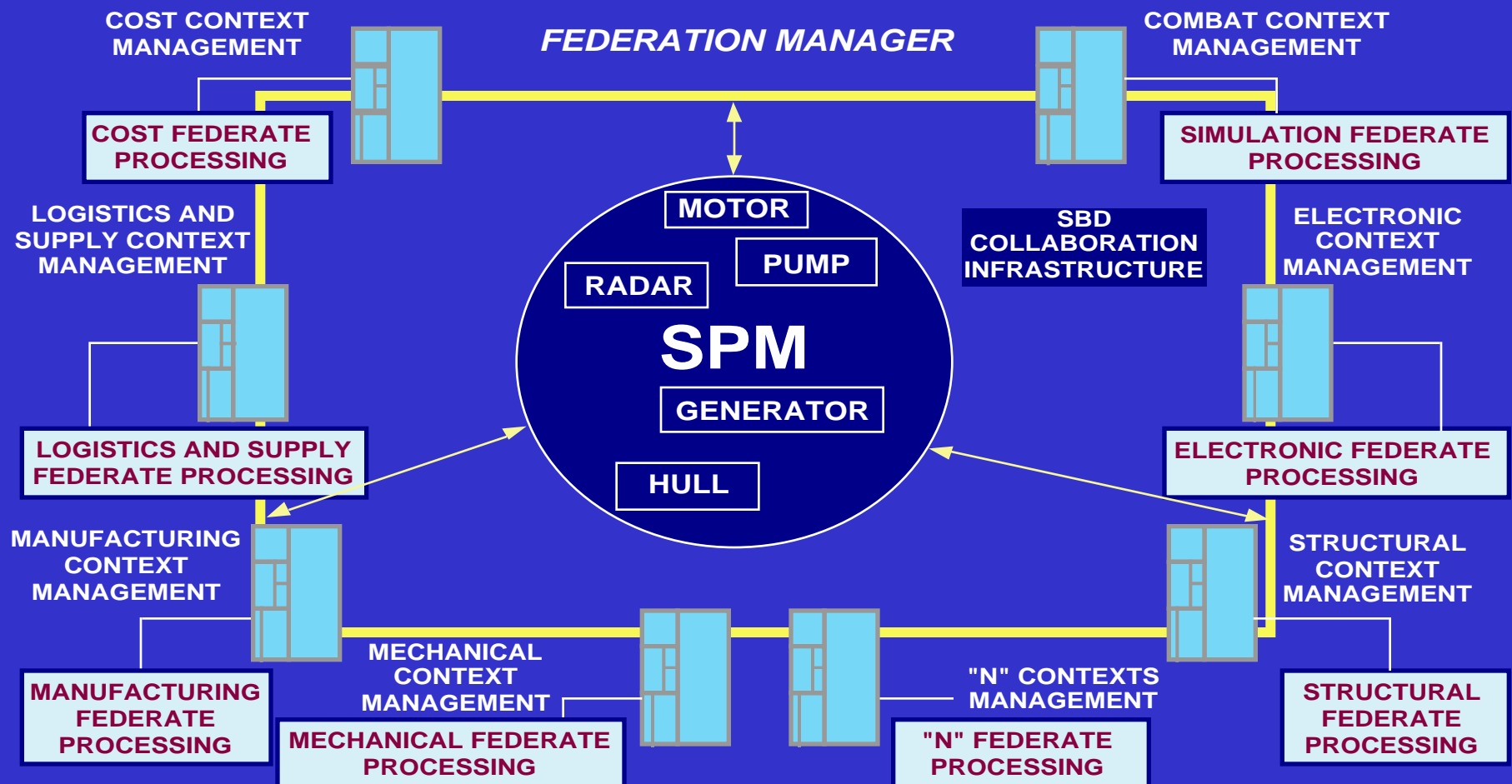




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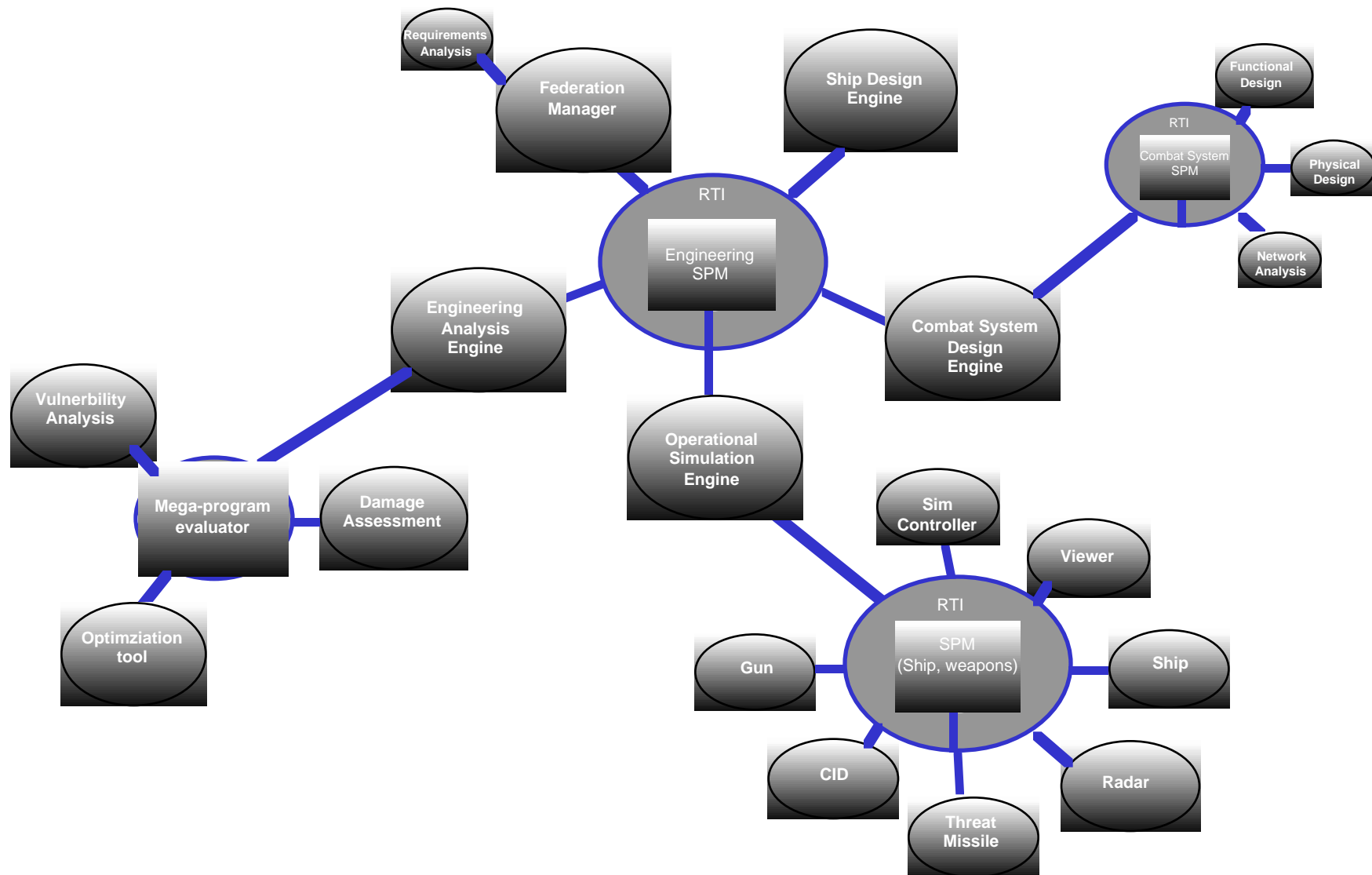


SBD Architecture Overview





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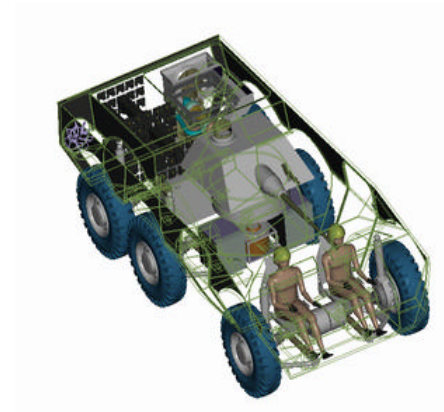
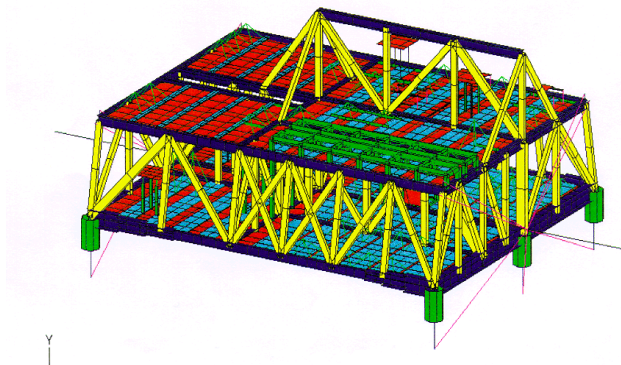
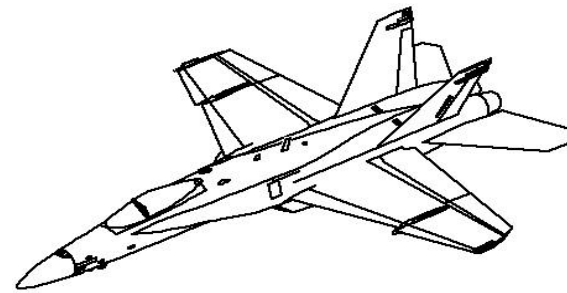
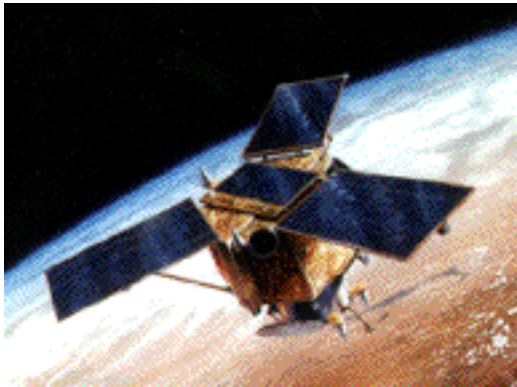


User Involvement

- **Aeroelastic Wing - Advanced Structural Design**
- **Virtual Satellite - Scaled Manufacturing**
- **Electro-mechanical System**
- **Submarine Virtual Test & Evaluation - Synthetic Shock Environment**



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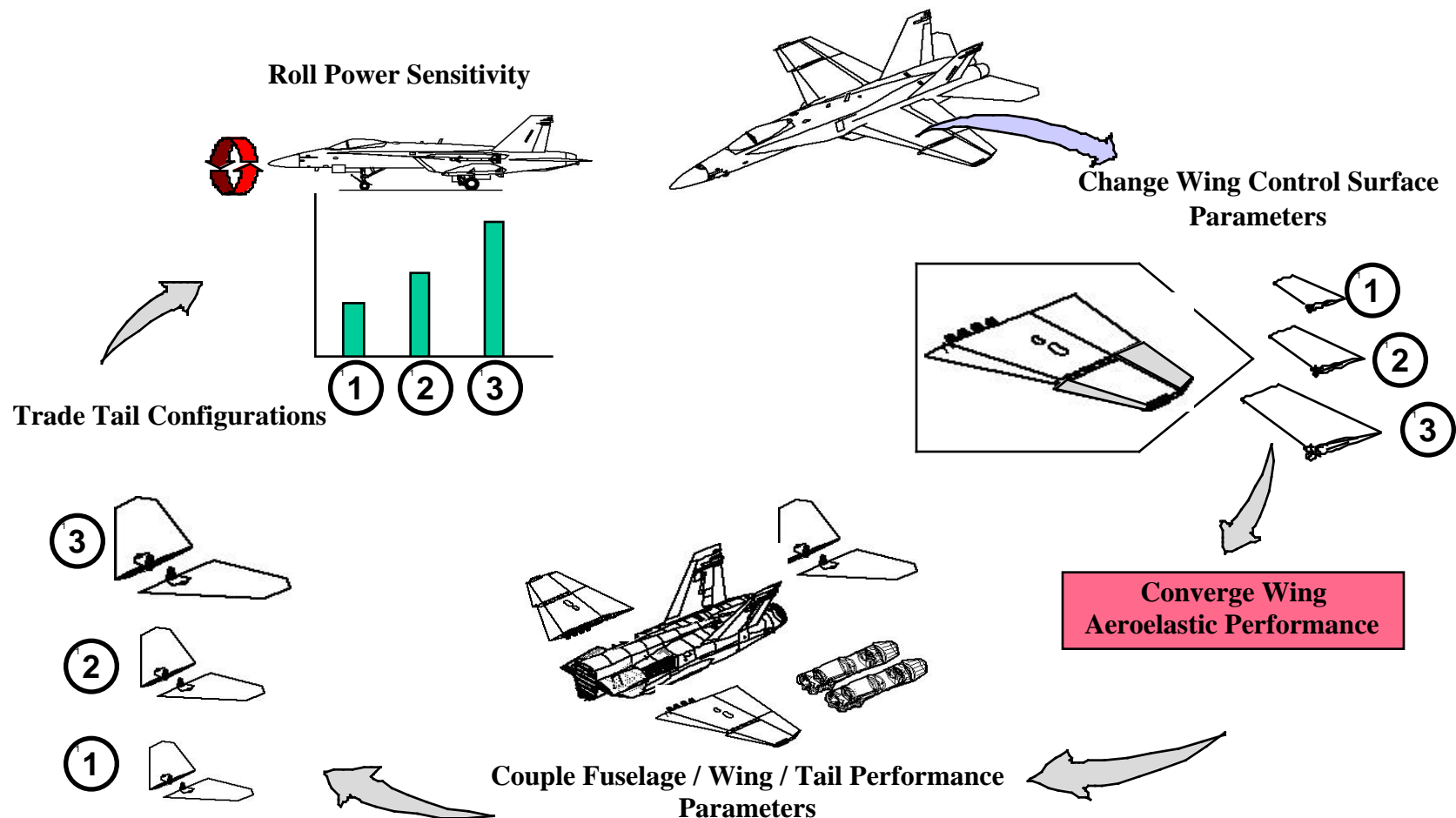


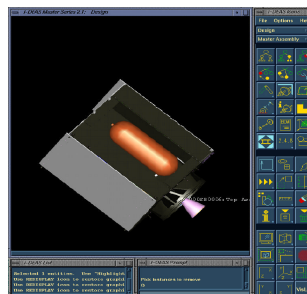
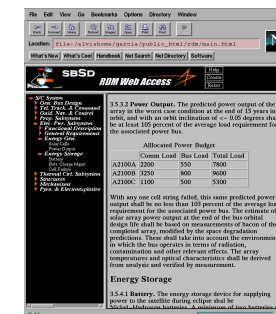
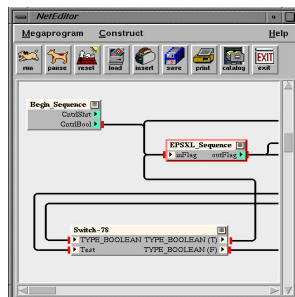
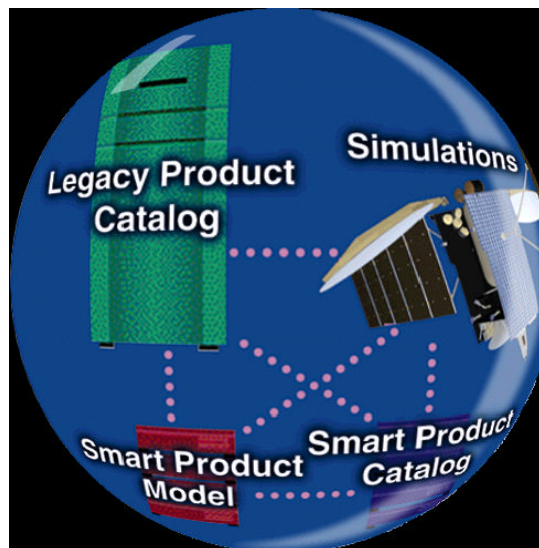


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Aircraft SPM Practical Demonstration



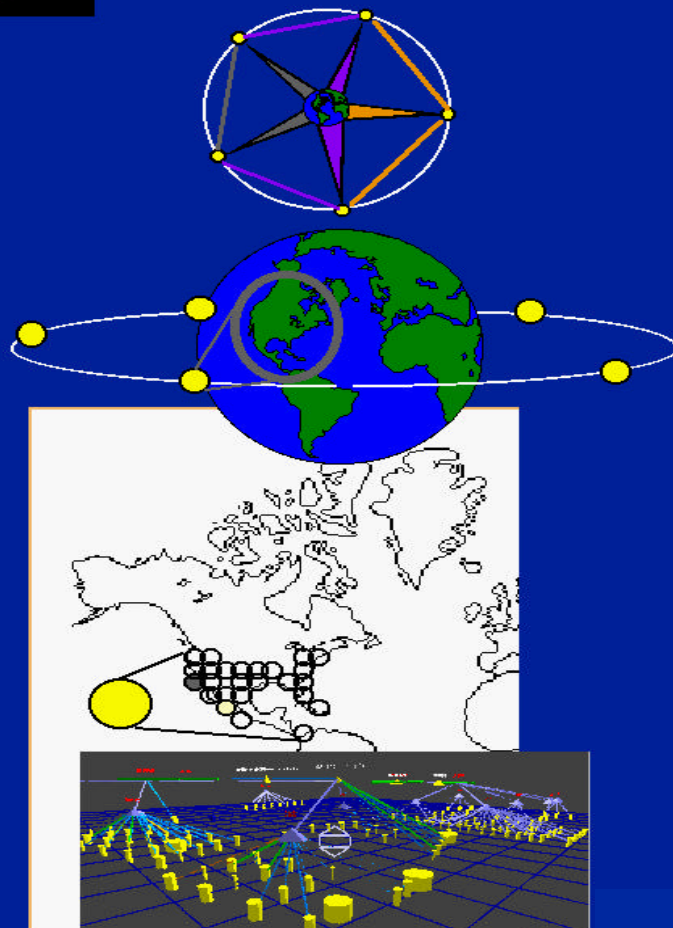
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Operational Visualization Scenarios



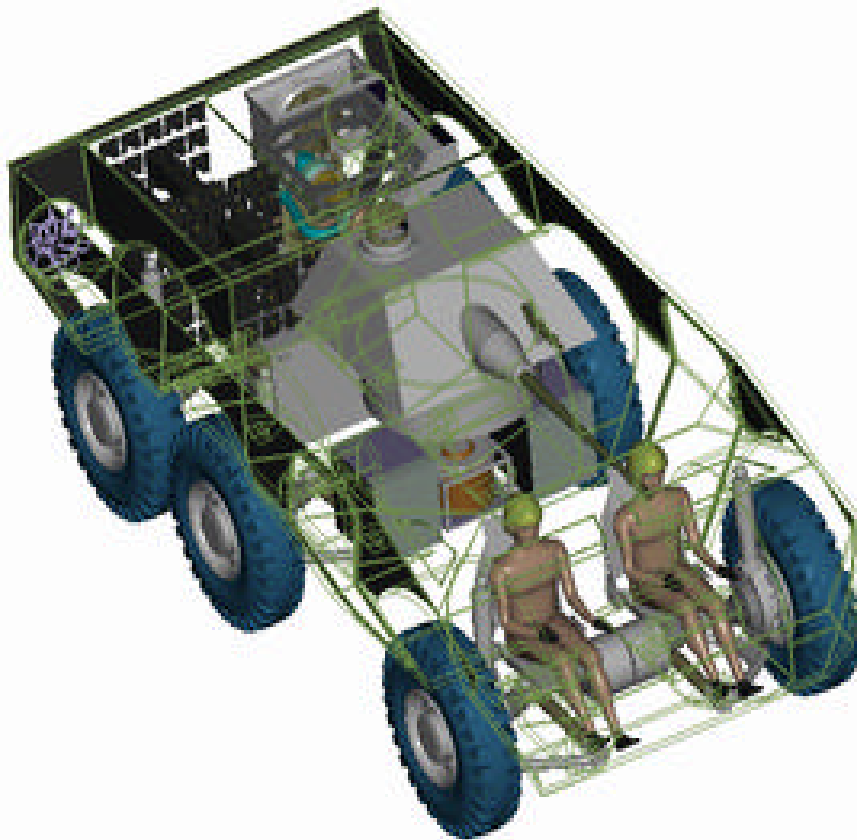
- **Constellation view**
 - Bandwidth (BW) utilization showing spatial distribution
 - Traffic mix & performance visualization
 - » Temporal & spatial traffic/revenue analysis
 - » Cell loss rate & cell/call delay variations
- **Single satellite coverage view**
 - “Tune” antenna patterns to align traffic mix, available BW & payload dutycycle
 - Revenue impacts of degraded satellite performance, loss of service
- **End-to-end system view**
 - NCC
 - Gateways
 - Interfaces to terrestrial telecomm providers
 - Revenue-generating Enterprise networks & end users



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Hybrid Electric Combat Vehicles



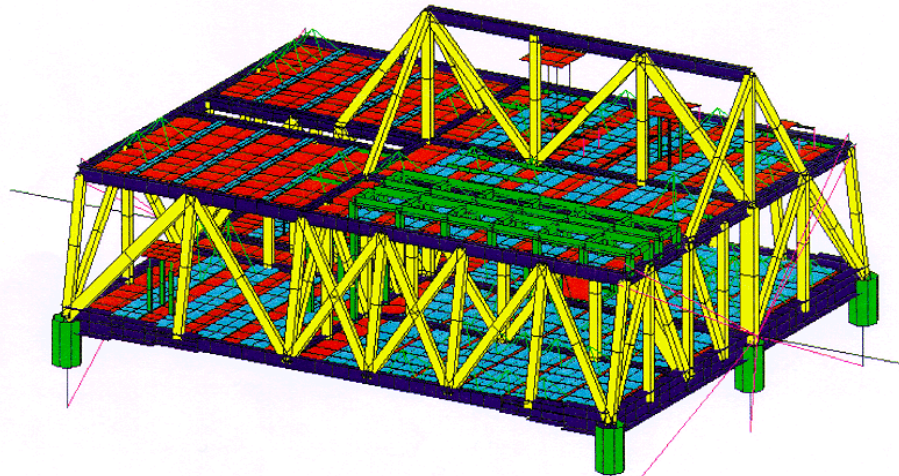
- **Mission and Requirements**
- **Weight and Volume Control**
- **Power System Architecture and Load Management**
- **Thermal Management**
- **Power Quality/Stability**
- **Electromagnetic Compatibility and Grounding**
- **Fault Tolerance**



Simulation-Based Design



1 Dynamic Shock and Vibration Simulation Acting on SPMs for Analysis



Linked Product Models of Complex Deck Structure and Shock/Vibration Mount

2 Comparison with Physical Model Analysis for Initial Validation

3 Design/Analyze Mounts

4 Construct/Test



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Where Is SBD Now?

- **Its Here Today:**
 - Core Software Modules
 - Templates to integrate tools
 - Guidelines to populate a product & process model
 - Start-up libraries
- **Its Available:**
 - Web site for downloading software and information
 - On-line FAQ section & Help line
 - Application & integration support

sbdhost.parl.com



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What do You Have to do to get SBD?

- **We are building the core environment. The users will need to populate product models and assemble analytical tools.**
- **Users will have to procure supporting software and/or licenses.**
- **Users will have to provide for personnel training and for process incorporation into their program.**
- **We are actively looking for service users who have a need and a desire for this capability.**



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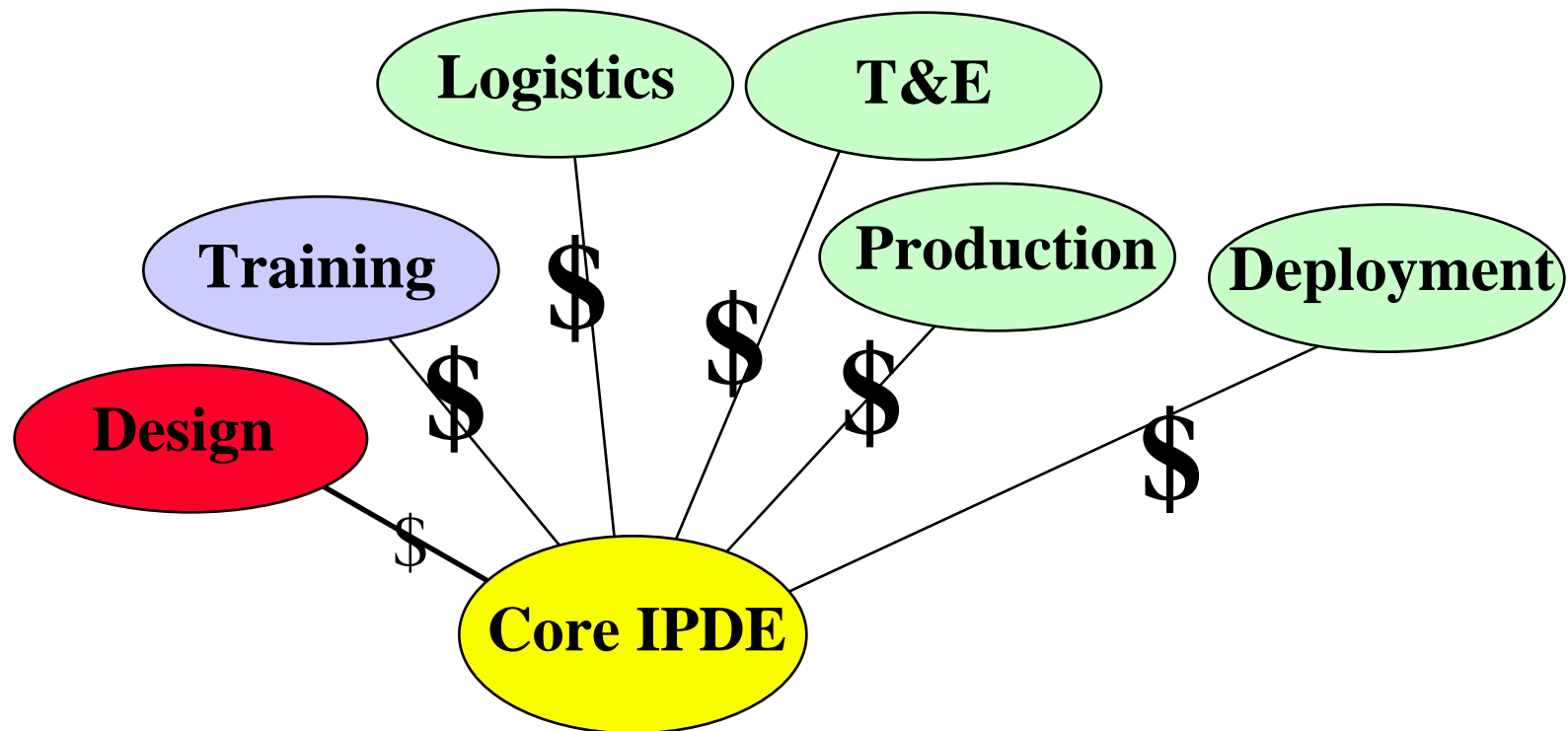
Future of SBD

- **Refinement Of the Core System Planned For This Year**
 - **Improve SPM Services and Functionality**
 - **Expand Communications Capabilities**
 - **Expand Federation / Task Execution & Control**
-
- **Continue with the Domain Extensibility Exercises**
-
- **Proceed in the Upcoming Phase to the Productization Of the SBD Core Processing System Software**
-
- **Apply to Two SBD Pilots (Comms Satellite and ASC/ISD) and others where opportunities and resources permit**

Transition from DARPA



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To this point we've only begun to exploit the potential



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Summary



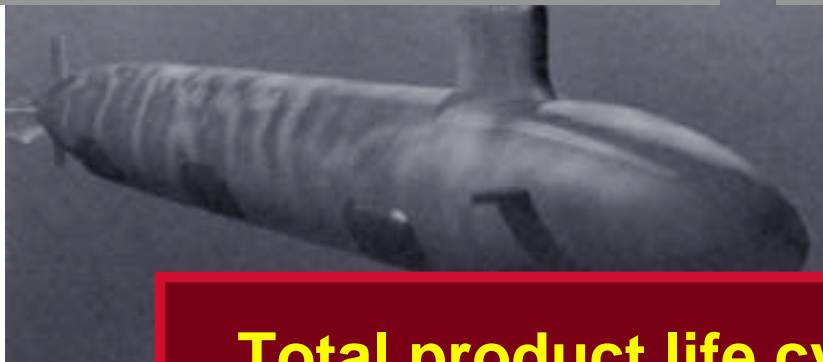
**Total Ownership Lifecycle
Support Up Front In Design**

**Comprehensive Exploration Of
Trade Space To Select Best
Value Design**



**Seamless Transition From
Design To Manufacturing**

**Embedded Training at System
and System of Systems Levels**



Total product life cycle ownership